(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 246 705**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87200927.9**

(51) Int. Cl.³: **G 11 B 5/52**

(22) Date of filing: **16.12.83**

(30) Priority: **17.12.82 JP 222298/82**

(43) Date of publication of application:
25.11.87 Bulletin 87/48

(84) Designated Contracting States:
DE FR GB NL

(60) Publication number of the earlier application in accordance with Art. 76 EPC: **0 113 986**

(71) Applicant: **SONY CORPORATION**
7-35 Kitashinagawa 6-Chome Shinagawa-ku
Tokyo 141(JP)

(72) Inventor: **Odaka, Kentaro**
c/o Sony Corporation 7-35 Kitashinagawa 6-chome
Shinagawa-ku Tokyo(JP)

(74) Representative: **Cotter, Ivan John et al,**
D. YOUNG & CO. 10 Staple Inn
London WC1V 7RD(GB)

(54) Methods of and apparatus for recording an information signal.

(57) In a method of and apparatus for recording a digital information signal, an information signal to be recorded is pulse-code-modulated (PCM) and the PCM signal is recorded on a recording medium by a rotary head, as slanting tracks (T) with no guard bands between adjacent tracks, and then reproduced therefrom. A tracking pilot signal (P) is recorded on a part or parts (PT_1, PT_2, PT_3) of each track (T) independently of the PCM signal. The recording positions of the pilot signals (P) on respective tracks (T) are deterined in such a manner that, as viewed from a direction perpendicular to the tracing direction (13) of the rotary head, the positions are not superimposed upon one another, that is they do not overlap one another. Upon reproducing, when a recorded track is traced by the rotary head, the pilot signals from both tracks adjacent to the track to be traced are reproduced and a tracking signal is generated from the reproduced outputs whereby a playback rotary head traces the record track.

FIG. 3

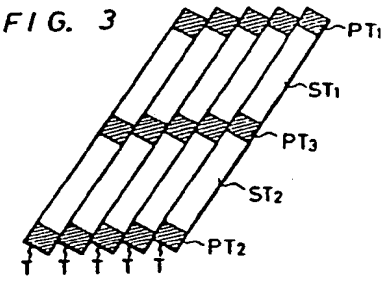
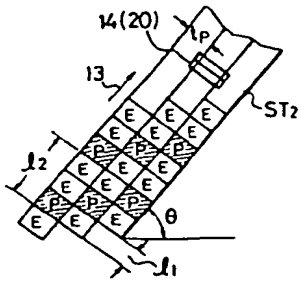


FIG. 4



EP 0 246 705 A1

Croydon Printing Company Ltd.

METHODS OF AND APPARATUS FOR RECORDING AN INFORMATION SIGNAL

This invention relates to methods of and apparatus for recording an information signal on a recording medium by way of a rotary magnetic head.

It has been proposed that, when a video signal and an audio signal are to be recorded on a magnetic tape in the form of one slanting track per unit time by means of a rotary head assembly of helical scan type and then reproduced therefrom, the video signal and the audio signal are pulse-code-modulated (PCM) and then recorded and reproduced. A reason for this is that, if the video signal and so on are pulse-code-modulated, high definition recording and reproducing become possible.

In this case, in a conventional video tape recorder (VTR), tracking control of the rotary head to cause the head correctly to trace or track the record track upon reproducing is carried out as follows. Upon recording, tracking control is carried out in that a control signal, which is recorded on one edge of the magnetic tape (in its width direction) by a stationary or fixed magnetic head, is reproduced by the fixed head and the reproduced control signal and the rotary phase of the rotary head have a constant mutual phase relationship. In this tracking control method, therefore, a special fixed magnetic head must be provided for tracking control. When it is desired that the recording and reproducing apparatus be made small in size, such fixed magnetic head causes a disadvantage in view of its mounting place and so on.

Therefore, to provide a tracking control method which does not use the fixed head, the following method has been proposed. In this method, for example, an analog video signal is recorded and reproduced in a so-called successive state (that is a state in which a guard band is not formed between adjacent tracks), and a tracking pilot signal is recorded by the rotary head and superimposed on the track on which the video signal is recorded. The pilot signal frequency is in a low frequency band below the frequency spectrum of the recorded video signal so that, upon reproducing, the pilot signal can be separated with ease. However, since the pilot signal is of relatively low frequency, it is rather difficult to erase the pilot signal.

Therefore, if, while erasing a signal which was previously recorded, a new signal is newly recorded on that portion, the disadvantage arises that the preceding recorded signal remains. Depending on the modulation system, when the information signal to be recorded has a spectrum in the low frequency band, like a PCM signal, it is quite difficult to separate the pilot signal.

Furthermore, since frequencies of four kinds are used as the pilot signal, the construction of the circuit becomes complicated.

UK Patent Application Publication No. GB-A-2 067 793 describes a tracking control system in which reference signal bursts are provided as tracking pilot signals spaced along each slanting track but staggered for adjacent tracks. The tracking pilot signals in each track are spaced by an integer number of line intervals, typically 2 or 3, and each tracking pilot signal is included within part of the horizontal blanking interval of the video signal. The tracking pilot signals are gated with gating pulses during reproduction, the pulses being timed to suppress pilot signals from the track being read but to detect pilot signals from adjacent tracks reproduced as a result of mistracking. The resulting error signals correct the tracking by adjusting the speed of the rotary heads and/or by lateral displacement of the heads.

According to the invention there is provided a method of recording an information signal on a plurality of slanting tracks on a recording medium by way of a pair of rotary heads having different azimuth angles, the method comprising:

recording the information signal on each of the slanting tracks formed without a guard band between adjacent tracks on the recording medium by the rotary heads; and

recording a tracking pilot signal on each of the slanting tracks, wherein the positions at which the tracking pilot signal is recorded on any three adjacent tracks are such as not to overlap one another in a direction perpendicular to the tracking direction of the rotary heads;

characterised in that:

the information signal is digitised to form a digital information signal for recording on the recording medium;

the tracking pilot signal is recorded in a predetermined area on each track independently of the digital information signal, the predetermined

area being in the same position on each of the tracks;

an erasing signal is recorded in the predetermined area where no tracking pilot signal is recorded; and

the tracking pilot signal in the predetermined area on any one of the tracks is arranged not to overlap the tracking pilot signals in the predetermined areas on the adjacent two tracks in the direction perpendicular to the tracking direction.

The invention also provides apparatus for recording an information signal on a plurality of slanting tracks on a recording medium, the apparatus comprising:

a pair of rotary heads having different azimuth angles and operative to record the information signal on each of the slanting tracks formed without a guard band between adjacent tracks on the recording medium, the rotary heads also being operative to record a tracking pilot signal on each of the slanting tracks, wherein the positions at which the tracking pilot signal is recorded on any three adjacent tracks are such as not to overlap one another in a direction perpendicular to the tracking direction of the rotary heads;

characterised in that:

the information signal is digitised to form a digital information signal for recording on the recording medium;

the tracking pilot signal is recorded in a predetermined area on each track independently of the digital information signal, the predetermined area being in the same position on each of the tracks;

an erasing signal is recorded in the predetermined area where no tracking pilot signal is recorded; and

the tracking pilot signal in the predetermined area on any one of the tracks is arranged not to overlap the tracking pilot signals in the predetermined areas on the adjacent two tracks in the direction perpendicular to the tracking direction.

The invention will now be further described, by way of illustrative and non-limiting example, with reference to the accompanying drawings, in which like references designate like elements and parts throughout, and in which:

Figure 1 is a diagram showing a recording track pattern effected by a previously proposed tracking control system;

Figure 2 is a block diagram showing the previously proposed tracking control system;

Figure 3 is a diagram showing a recording track pattern effected by a recording apparatus embodying the present invention;

Figure 4 is a diagram for explaining details of the track pattern shown in Figure 3;

Figure 5 is a block diagram showing a tracking control system for use with a recording apparatus embodying the present invention; and

Figures 6A to 6C are respective waveform diagrams for explaining the operation of the system of Figure 5.

Before describing an embodiment of the present invention, a previously proposed tracking control method will be described with reference to Figures 1 and 2. Two rotary heads HA and HB (only HB being shown in Figure 2), each having a different so-called azimuth angle, are located so as to have an angular distance of 180^{o} between them. Pilot signals of four different frequencies, for example $f_1 = 100$ kHz, $f_2 = 115$ kHz, $f_3 = 160$ kHz and $f_4 = 145$ kHz, are used. The rotary head HA sequentially forms alternate tracks T_1 and T_3 on which an FM-modulated video signal is recorded. The pilot signal with the frequency f_1 is recorded on the track T_1, being superimposed on the recorded video signal, while the pilot signal with the frequency f_3 is recorded on the track T_3, being superimposed upon the recorded video signal. The other rotary head HB sequentially forms alternate tracks T_2 and T_4 on which the FM-modulated video signal is recorded. The pilot signal with the frequency f_2 is recorded on the track T_2, being superimposed on the recorded video signal, while the pilot signal with the frequency f_4 is recorded on the track T_4, being superimposed upon the recorded video signal. The tracks T_1 T_2, T_3 and T_4 are formed in a so-called successive state, that is there are no guard bands between adjacent tracks.

Tracking control upon reproducing is carried out as follows. Since approximately the same tracking control operation is performed for each of the respective two rotary heads HA and HB, only the control operation for one head, namely the head HB, will be described with reference to Figure 2.

When the rotary head HB correctly traces the track T_2 or T_4, a "just tracking" or correct tracking state of the head HB is performed. As shown in Figure 2, an output reproduced by the head HB is supplied through a

playback amplifier 1 to a low pass filter 2 from which only a pilot signal in the low frequency band is derived. This low frequency band component is supplied to a multiplying circuit 3 in which it is multiplied by a signal having the frequency f_2 from an oscillator 4.

When the head HB traces the track T_2, as shown by a reference numeral 11 in Figure 1, the multiplying circuit 3 generates a signal E_1 having a frequency of $(f_2 - f_1) = 15$ kHz and a signal E_2 having a frequency of $(f_3 - f_2) = 45$ kHz. When the head HB traces the track T_4, as shown by a reference numeral 12 in Figure 1, the multiplying circuit 3 generates a signal S_I having a frequency of $(f_4 - f_2) = 30$ kHz in addition to the signal E_1 having the frequency of $(f_2 - f_1) = 15$ kHz and the signal E_2 having the frequency of $(f_3 - f_2) = 45$ kHz.

The signals E_1 and E_2 are reproduced outputs of the pilot signals from the adjacent tracks which are not to be traced by the head HB. As is clear from Figure 1, if the reproduced output levels of both the signals E_1 and E_2 are equal to each other, the head HB is correctly tracing the tracks T_2 and T_4. Accordingly, if tracking control is carried out so as to make the reproduced output levels of the signals E_1 and E_2 equal, the "just tracking" state can be established.

To this end, an output from the multiplying circuit 3 is supplied to band pass filters 5 and 6. The bandpass filter 5 derives the signal E_1 having the frequency of 15 kHz, while the bandpass filter 6 derives the signal E_2 having the frequency of 45 kHz. The signals E_1 and E_2 are supplied to respective input terminals of a differential amplifier 7, which produces an output representing any difference between the signals E_1 and E_2. The output from the differential amplifier 7 is used to control a capstan motor, for example, in such a manner that the transport of the tape is controlled so as to reduce any difference output from the differential amplifier 7 to zero.

The pilot signals of the tracks T_2 and T_4 have opposite frequency relations to the pilot signals of the adjacent tracks on the left and right-hand sides. Therefore, each time that the head HB traces the track T_2 or T_4, the tracking control direction must be reversed. That is to say, when the head HB traces the track T_2 the output of the pilot signal of the track T_2 is not delivered from the multiplying circuit 3, while when the head HB traces the track T_4 the signal S_I having the frequency of $(f_4 - f_2) = 30$ kHz is obtained therefrom, as mentioned above. Therefore, when the signal S_I is

detected, the direction of the tracking control is reversed.

Outputs S_E and $\overline{S_E}$ from the differential amplifier 7, which are opposite in polarity, are supplied to respective input terminals of a switching circuit 8. The output from the multiplying circuit 3 is also supplied to a band pass filter 9 from which a signal component of 30 kHz is derived. This signal component is supplied to a detecting circuit 10 and thereby detected. When the signal S_1 having the frequency of 30 kHz is detected in the detecting circuit 10, the detecting circuit causes the switching circuit 8 to change over its position to deliver the output of the opposite polarity to control the capstan motor.

In the case of the other rotary head HA, if the signal having the frequency f_1 (rather than the signal having the frequency f_2) is supplied similarly from the oscillating circuit 4 to the multiplying circuit 3, the signal having the frequency $(f_2 - f_1) = 15$ kHz and the signal having the frequency $(f_4 - f_1) = 45$ kHz are obtained as the pilot signal outputs of the adjacent tracks. Tracking control is carried out so as to reduce any difference between the pilot signal outputs to zero. In this case, the direction of tracking control is reversed when a signal with the frequency $(f_3 - f_1) = 60$ kHz is detected.

When tracking control is carried out for one rotary head, since the one rotary head has a constant positional relationship relative to the other head it is not necessary to carry out tracking control for the other rotary head.

The above-described previously proposed method uses a signal of relatively low frequency as the pilot signal so that it is rather difficult to erase the recorded pilot signal. Therefore, in the event that, while erasing a signal recorded previously on a portion, a new signal is newly recorded on the same portion by being superimposed thereon, there occurs a disadvantage that the preceding recorded signal remains. Furthermore, depending on the modulation system, when the information signal to be recorded has a frequency spectrum in the low frequency band like a PCM signal, it is quite difficult to separate the pilot signal from the other signals. In addition, since signals of four different frequencies are used as the pilot signals, the construction of the circuit is complicated.

A method and apparatus embodying the invention for recording a digital information signal will now be described with reference to Figures 3

to 6.

In the present embodiment, a PCM signal is timebase-compressed thereby to form a recording area on a record track for a tracking pilot signal. As shown in Figure 3, pilot signal areas PT_1 and PT_2 are formed at opposite ends of each record track T in the longitudinal direction thereof. At the same time, a PCM signal to be recorded as one track is halved so that one PCM signal is recorded on a PCM area ST_1 and the other PCM signal is recorded on a PCM area ST_2. Also, a pilot signal area PT_3 is formed between the areas ST_1 and ST_2 of each track T.

On each of the pilot signal areas PT_1, PT_2 and PT_3 there is recorded a pilot signal of constant frequency in a pattern shown in Figure 4. The frequency of the pilot signal is selected to be of a value having a relatively small azimuth loss, for example approximately 100 kHz to 500 kHz.

In Figure 4, reference letters P designate the pilot signals, which are arranged so as not to be superimposed or to overlap as viewed from a direction perpendicular to the tracing or tracking direction of the head, which tracing direction is shown by an arrow 13. Therefore, even if the rotary head traces the three tracks shown in Figure 4, the reproduced output of the pilot signal P from each track cannot have a pilot signal from an adjacent track superimposed on it. In order to realise this operation, if the pitch or width of the track T is taken as t_p and the angle of inclination of the track T relative to the longitudinal direction of the magnetic tape is taken as θ, a distance l_1 between the recording positions of the pilot signals P on adjacent tracks in one tracing direction of the head must be selected so as to be greater than $t_p/\tan\theta$. When a plurality of pilot signals P are recorded on the respective areas PT_1, PT_2 and PT_3 of one track, as shown in Figure 4, a distance l_2 between the recording positions of one pilot signal and the next pilot signal in the tracing direction of the head in each track is selected to be of a value which satisfies the condition that $l_2 = 3l_1$.

In Figure 4, reference letter E represents a signal for erasing the pilot signal P. The reason for providing the erasing signal is as follows. When the pilot signal P is recorded as described above, the recorded portion of the pilot signal P of one track adjoins a portion of the adjacent track on which no pilot signal is recorded. When no signal is recorded on this portion, if a signal is thereafter newly recorded on the tape the recorded tracks are not always coincident with each other. As a result, the previously recorded

pilot signal P could partially remain, that is not be erased. Therefore, in view of the possibility of a subsequent recording, the signal E which can erase the pilot signal P is recorded on that portion.

The tracking control operation which employs the pilot signal P will now be described.

Let it be assumed that, when a rotary head 20 traces the central track shown in Figure 4, the rotary head 20 traces across three tracks as shown by a reference numeral 14.

Figure 5 is a block diagram showing an example of a tracking control circuit for use with the apparatus embodying the present invention. An output from the rotary head 20 is supplied through a playback amplifier 21 to a pilot signal extracting circuit 22 from which only the reproduced output of the pilot signal P is derived. The pilot signal extracting circuit 22 may comprise a tank circuit which is tuned only to the pilot signal frequency. As shown in Figure 6A, the pilot signal derived from the extracting circuit 22 contains a pilot signal output P_M which appears from the central track and has a large level, and pilot signal outputs P_R and P_L which appear from the right-hand side and left-hand side tracks, respectively, and are of a small level. The sequence or order in which the outputs P_M, P_R and P_L appear is always the same when the rotary head 20 traces the respective different tracks.

The output signal from the pilot signal extracting circuit 22 is supplied to sample and hold circuits 23 and 24.

A pulse PG, delivered from a pulse generator 26 upon each revolution of a drive motor 25 for driving the rotary head 20 and indicating the rotary phase of the rotary head 20, is supplied to a pulse generating circuit 27. In response to the pulse PG, the pulse generating circuit 27 generates a signal S_1 (Figure 6B) at a point in time when the head 20 traces the pilot signal portion of the right-hand track and a signal S_2 (Figure 6C) at a point in time when the head 20 traces the pilot signal portion of the left-hand track. The signal S_1 is supplied to the sample and hold circuit 23 and the signal S_2 is supplied to the sample and hold circuit 24. Consequently, the sample and hold circuit 23 generates a sampled and held output of a reproduced pilot signal output P_R which is derived from the right-hand track, while the sample and hold circuit 24 generates a sampled and held output of a reproduced pilot signal output P_L which is derived from the left-hand track.

The sampled and held outputs are supplied to respective input terminals of a differential amplifier 28. The differential amplifier 28 produces a difference output representing any difference between the inputs thereto, which difference signal is delivered to a capstan motor (not shown). The capstan motor is so controlled that the amount of transport of the tape is controlled so as to reduce any difference in level between the outputs P_R and P_L to zero, whereby, when the head 20 traces the central track, it traces the adjacent tracks on the opposite sides of the central track by the same amount.

In the above embodiment, signals which are all of the same frequency are employed as the pilot signal P. In a case where a plurality of heads having different azimuth angles are employed, it is possible to use a pilot signal with a different frequency for each head with a different azimuth angle.

Mis-tracking can be avoided, without changing the frequency of the pilot signal for each head which has a different azimuth angle, by the following methods. According to one method, at a point in time when playback is started, prior to playback proper, the output levels of high frequency signals, which are outputs reproduced by, for example, two heads, each having a different azimuth angle, are inspected. In other words, the level of the high frequency output obtained when one head traces a track having a particular azimuth angle is compared with the level of the high frequency output obtained when the other head traces the track having the same azimuth angle whereby the respective heads are controlled in advance so as to trace the tracks having the corresponding azimuth angles.

According to another method, upon reproducing the high frequency outputs from the respective heads are inspected all the time. When the level of the high frequency output becomes less than a predetermined level (at this time the head is scanning a track which has a different azimuth angle), an error voltage is added to the tracking signal by means of which, in the case of two heads, the tracking positions thereof are displaced by one track pitch at a maximum.

Although three pilot signal record areas are provided in the example shown in Figure 3, the provision of at least one record area is sufficient. However, when, as in the example shown in Figure 3, a pilot signal record area is provided at both end portions and a central portion of the record

track, there is an advantage that even if the record track is, for example, curved, excellent tracking can be carried out.

The sampling pulses S_1 and S_2 used in Figure 5 can be derived by a method which does not use the pulse PG, but utilises the fact that the level of the reproduced output P_M of the pilot signal from, for example, the main track is higher than those of the reproduced outputs P_R and P_L of the pilot signals from the tracks adjacent the opposite sides of the main track. The output P_M is detected and, on the basis of the detected output, the signals S_1 and S_2 are formed by employing a delay element such as a monostable multivibrator or the like.

Our copending European Patent Application No. 83307691.2 (EP-A-0 113 986), from which the present application was divided out, relates to similar subject matter.

CLAIMS

1. A method of recording an information signal on a plurality of slanting tracks on a recording medium by way of a pair of rotary heads having different azimuth angles, the method comprising:

recording the information signal on each of the slanting tracks (T) formed without a guard band between adjacent tracks on the recording medium by the rotary heads (HA,HB); and

recording a tracking pilot signal (P) on each of the slanting tracks (T), wherein the positions at which the tracking pilot signal (P) is recorded on any three adjacent tracks (T) are such as not to overlap one another in a direction perpendicular to the tracking direction (13) of the rotary heads (HA,HB);

characterised in that:

the information signal is digitised to form a digital information signal for recording on the recording medium;

the tracking pilot signal (P) is recorded in a predetermined area (PT) on each track (T) independently of the digital information signal, the predetermined area (PT) being in the same position on each of the tracks (T);

an erasing signal (E) is recorded in the predetermined area (PT) where no tracking pilot signal (P) is recorded; and

the tracking pilot signal (P) in the predetermined area (PT) on any one of the tracks (T) is arranged not to overlap the tracking pilot signals (P) in the predetermined areas (PT) on the adjacent two tracks (T) in the direction perpendicular to the tracking direction.

2. A method according to claim 1, wherein the recording medium is a magnetic tape and the pilot signal (P) and the erasing signal (E) are recorded in each of two said predetermined areas (PT_1,PT_2) located at both ends of each of the slanting tracks (T).

3. A method according to claim 2, wherein the pilot signal (P) and the erasing signal (E) are also recorded in a further predetermined area (PT_3) at the centre of each of the slanting tracks (T).

4. A method according to claim 1, claim 2 or claim 3, wherein the pilot signal (P) is recorded at a plurality of positions in the or each predetermined area (PT_1,PT_2,PT_3) and the erasing signal (E) is recorded between the positions at which the pilot signal (P) is recorded.

5. Apparatus for recording an information signal on a plurality of slanting tracks on a recording medium, the apparatus comprising:

a pair of rotary heads (HA,HB) having different azimuth angles and operative to record the information signal on each of the slanting tracks (T) formed without a guard band between adjacent tracks on the recording medium, the rotary heads (HA,HB) also being operative to record a tracking pilot signal (P) on each of the slanting tracks (T), wherein the positions at which the tracking pilot signal (P) is recorded on any three adjacent tracks (T) are such as not to overlap one another in a direction perpendicular to the tracking direction (13) of the rotary heads (HA,HB);

characterised in that:

the information signal is digitised to form a digital information signal for recording on the recording medium;

the tracking pilot signal (P) is recorded in a predetermined area (PT) on each track (T) independently of the digital information signal, the predetermined area (PT) being in the same position on each of the tracks (T);

an erasing signal (E) is recorded in the predetermined area (PT) where no tracking pilot signal (P) is recorded; and

the tracking pilot signal (P) in the predetermined area (PT) on any one of the tracks (T) is arranged not to overlap the tracking pilot signals (P) in the predetermined areas (PT) on the adjacent two tracks (T) in the direction perpendicular to the tracking direction.

6. Apparatus according to claim 5, wherein the recording medium is a magnetic tape and the pilot signal (P) and the erasing signal (E) are recorded in each of two said predetermined areas (PT_1,PT_2) located at both ends of each of the slanting tracks (T).

7. Apparatus according to claim 6, wherein the pilot signal (P) and the erasing signal (E) are also recorded in a further predetermined area (PT_3) at the centre of each of the slanting tracks (T).

8. Apparatus according to claim 5, claim 6 or claim 7, wherein the pilot signal (P) is recorded at a plurality of positions in the or each predetermined area (PT_1,PT_2,PT_3) and the erasing signal (E) is recorded between the positions at which the pilot signal (P) is recorded.

0246705

FIG. 1

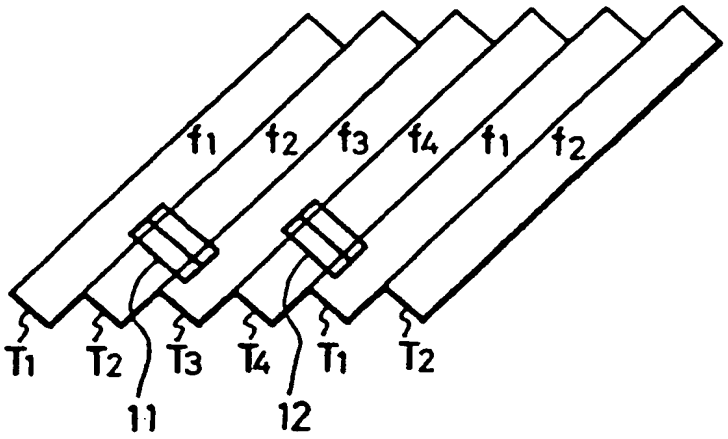
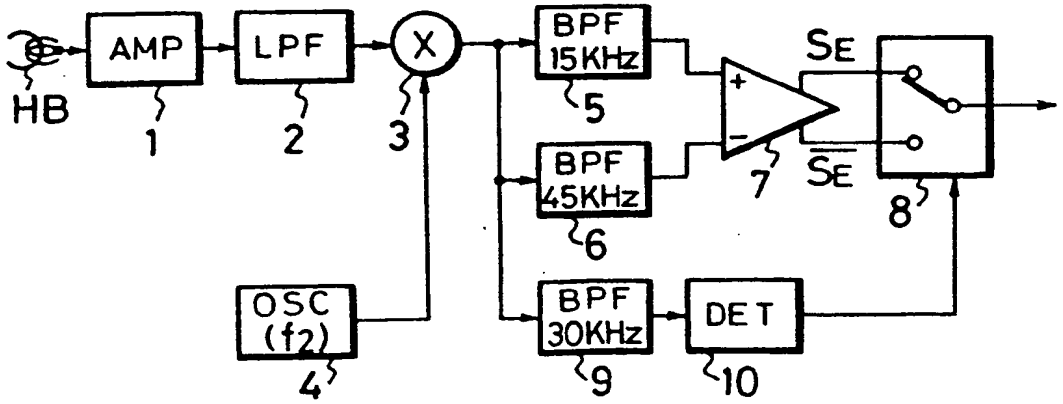


FIG. 2



0246705

FIG. 3

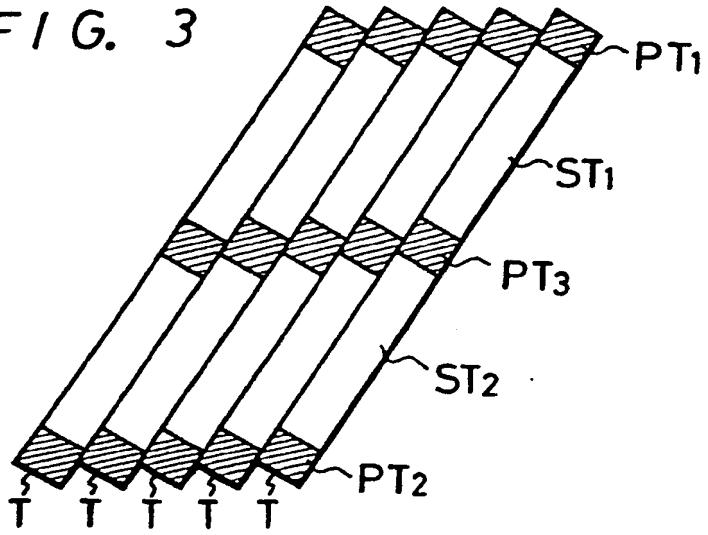
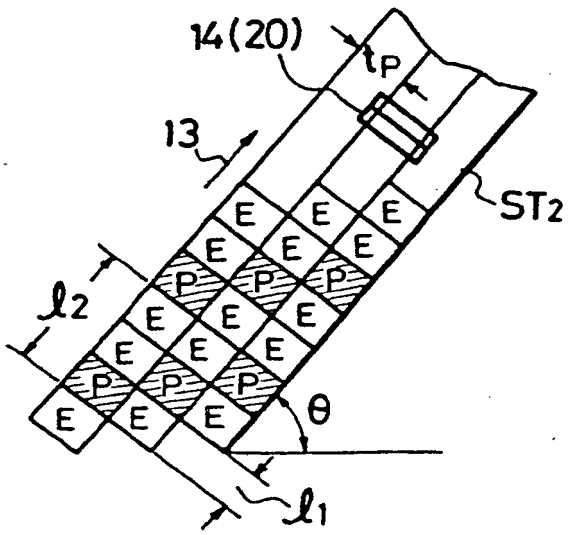


FIG. 4



0246705

FIG. 5

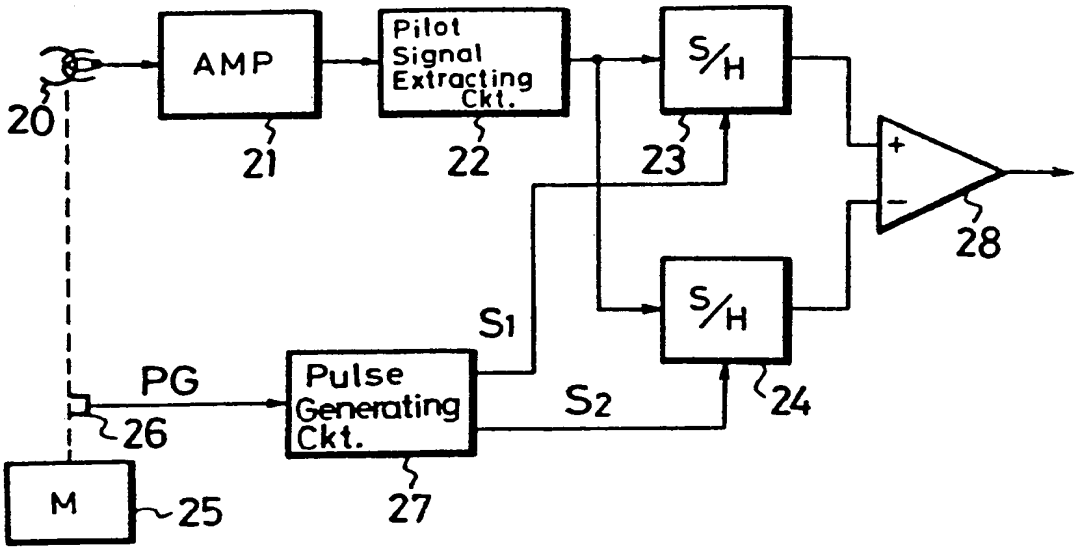


FIG. 6A

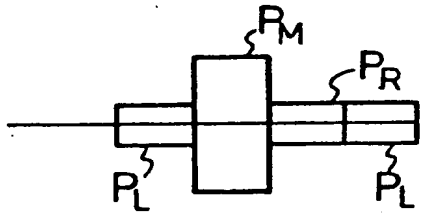


FIG. 6B

FIG. 6C

European Patent Office

EUROPEAN SEARCH REPORT

0246705

Application number

EP 87 20 0927

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl 4)
E	EP-A-0 117 753 (SONY CORP.) * Figure 19; page 21, lines 5-11 * ---	1-3,5-8	G 11 B 5/52
Y	FUNKSCHAU, vol. 51, no. 16, August 1979, pages 72-76, Munich, DE; "Video 2000 - ein neues Bildaufzeichnungssystem" * Figure 6; page 74, left-hand column * ---	1-9	
Y	GB-A-2 097 968 (SONY CORP.) * Abstract, last 5 lines * ---	1-9	
Y	US-A-3 919 697 (THE BATTELLE DEVELOPMENT CORP.) * Abstract; figure 1 * ---	1-9	TECHNICAL FIELDS SEARCHED (Int Cl 4) G 11 B
Y	PATENT ABSTRACTS OF JAPAN, vol. 7, no. 32 (P-174)[1177], 8th February 1983; & JP-A-57 186 227 (SONY K.K.) 16-11-1982 ---	2,3,6,7	
Y	NEUES AUS DER TECHNIK, no. 6, 15th December 1978, Vogel-Verlag, Würzburg, DE; "Spurfolgesystem" * Whole document * --- -/-	3,7	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29-07-1987	SCHEPENS

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503 03.82

0246705

Application number

EP 87 20 0927

European Patent Office

EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl.4)
Y	EP-A-0 048 581 (MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD) * Figure 10; page 2, lines 24-28; page 3, line 10 - page 5, line 9; page 20, lines 5-10; page 20, line 18 - page 23, line 7; page 26, line 26 - page 27, line 1 *	4,9	
A	GB-A-2 029 607 (N.V. PHILIPS)		
A	DE-A-3 107 738 (VICTOR CO. OF JAPAN)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29-07-1987	SCHEPENS

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503 03 82